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International trade and tax performance

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Abstract

This article examines a possible effect of de-globalisation and growing isolationism on countries' fiscal capacities by studying the relationship between international trade and tax performance. We address the endogeneity between trade and tax performance by instrumenting for trade openness with geographical determinants of bilateral trade through gravity model estimations. We find that trade openness has a positive causal effect on tax revenue as a percentage of GDP. Additionally, applying stochastic frontier analysis we find that trade openness positively influences tax efficiency. Our results suggest that the current retreat from global trade may have negative implications for countries' fiscal capacities, particularly for emerging markets where trade plays a crucial role in economic development.

Keywords: international trade, global tax, tax ratio, tax effort, tax inefficiency

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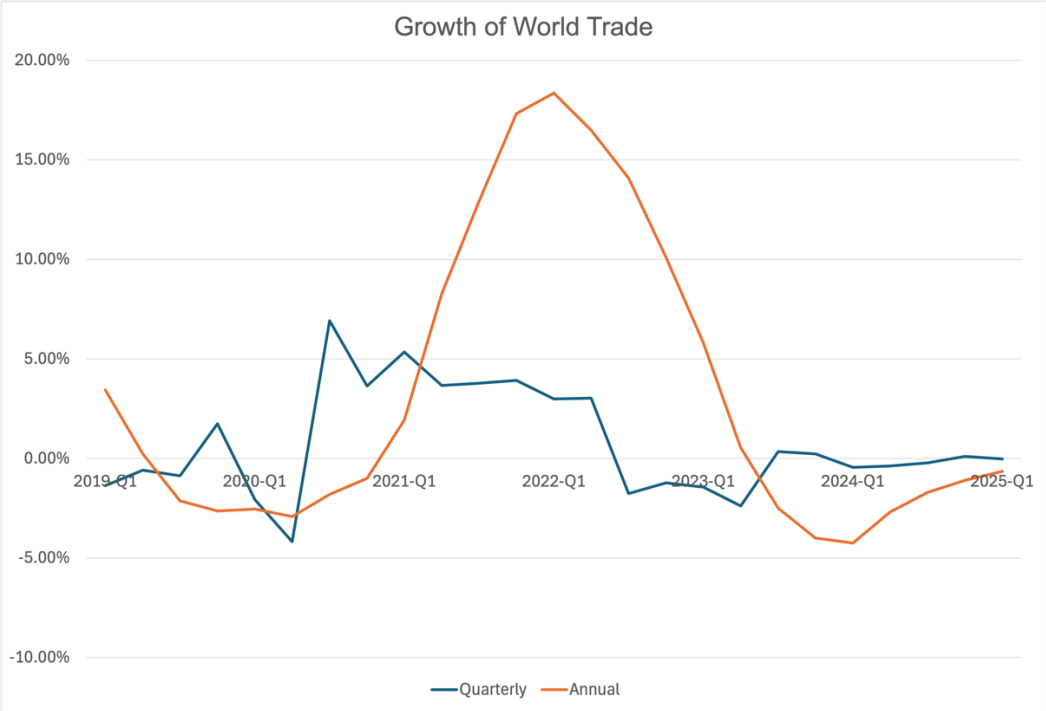
1. INTRODUCTION

'[T]he most beautiful word in the dictionary is tariff'.
– Donald Trump, quoted in Leonard (2024).

For decades, the expansion of global trade has played a central role in driving economic growth, promoting interdependence, and reducing poverty worldwide. Recent trends, however, indicate a retreat from global integration or even de-globalisation. Leading up to 2019, international merchandise trade has been on the decline and after a brief expansion following the collapse during the Covid-19 pandemic, resumed its slide through 2023 (see Fig. 1); trade in services, while growing, is still just one-third the volume of merchandise trade. This decline in global trade appears likely to accelerate as major industrialised nations increasingly embrace protectionist policies. The shift began notably in 2018, when President Donald Trump's administration began the US-China trade war and this protectionist trend has intensified dramatically in 2025, with President Trump initiating a broader trade war by imposing increased tariffs on all trading partners, including America's closest allies and largest economic partners.

Fig. 1: The Retreat of World Trade



Source: United Nations Conference on Trade and Development (UNCTAD), 'Global trade update' (March 2025).

Meanwhile, multilateral institutions like the World Trade Organization, heretofore responsible for upholding the global trading system, have experienced a substantial erosion of their influence and effectiveness.

This de-globalisation trend poses challenges for many countries, particularly for emerging markets for which international trade plays a significant role in the economy. To understand one critical impact of this retreat from world trade, in this article we study the effect of international trade on tax performance. In addition to the timeliness of the research question, our analysis contributes to the literature on trade and tax performance by addressing the endogeneity of these variables which allows us to estimate the causal effect of trade openness on tax performance. We employ two complementary methodological approaches. First, we use instrumental variable regression techniques to estimate trade's causal effect on the tax ratio (tax revenue as a percentage of gross domestic product (GDP)). Second, we apply stochastic frontier analysis following Tran-Nam and Le (2022) to assess how trade affects tax efficiency or the degree to which countries achieve their tax revenue potential given their economic and structural characteristics. Our findings suggest that trade openness has a positive causal effect on the tax ratio while our stochastic frontier analysis finds that trade openness positively influences tax efficiency.

In contrast to our article, previous studies on the relationship between trade and taxation have been mainly correlational, not causal. For example, Slemrod (2004) finds that openness is negatively associated with corporate tax rates and suggests the former is causing the latter due to international competitive pressures. Hines (2007) suggests that countries adjust tax policy in response to capital mobility but mainly motivate the argument with correlations in the data.

Morrissey and co-authors (2016) find that tax revenue in lower-income countries is more vulnerable to terms of trade shocks but this analysis also remains correlational in nature leaving the possibility that omitted factors could account for both countries' production specialisation and the ability to collect taxes. Similar limitations exist in the Khattry and Rao (2002) study on trade liberalisation and tax revenue. Studies such as Holzner, Jovanović and Vukšić (2021) consider the effect of corporate tax rates on exports and imports. This type of question is the reverse of the one we ask in this article and illustrates that correlational analysis could be biased by reverse causal effects as well. Baunsgaard and Keen (2010) do try to identify a causal relationship between trade liberalisation and lost revenue and the replacement of that revenue with value added taxes. The authors of that study employ a Generalised Method of Moments methodology which is an alternative to our instrumental variables approach. Our stochastic frontier analysis of trade's effect on tax inefficiency goes beyond these studies.

The article proceeds as follows. In the next section, we provide a theoretical discussion of the relationship between trade and tax performance and also of other factors that might affect tax performance. That is followed by a section in which we describe the methodology including a detailed description of the construction of the instrumental variable and the variables used in the gravity regressions to construct that instrument. We also describe the stochastic frontier analysis to study trade's effect on tax efficiency. This is followed by a detailed discussion of the results and a conclusion.

2. TRADE AND OTHER FACTORS AFFECTING TAX PERFORMANCE: THEORETICAL MOTIVATIONS

International trade can influence a country's tax performance through multiple channels that affect both the tax base and the efficiency of tax collection. Trade directly affects tax revenue through trade taxes and customs duties. While trade liberalisation typically reduces tariff rates, potentially decreasing direct revenue from trade taxes, the corresponding increase in trade volume can partially or fully offset this loss (see Khattry and Rao (2002) and Baunsgaard and Keen (2010)). Since a policy variable, namely tariff rates, drives both trade flows and tax collection this creates endogeneity in these two variables.

International trade can also expand the tax base. As shown by Frankel and Romer (1999), trade can promote economic growth through efficiency gains from specialisation, technology transfer, and market expansion. Firms engaging with international markets can also experience productivity gains through competition. Trade-oriented firms typically operate in the formal sector which makes tax collection easier. Trade is also often associated with foreign direct investment, which can expand the corporate tax base.

The efficiency of tax administration can also be enhanced by international trade. Trade integration creates pressure for institutional improvements, including tax administration reforms. Countries seeking to participate effectively in global markets frequently adopt international best practices in governance to remain competitive. Trade agreements facilitate information flows which can enhance tax collection while trade facilitation typically involves modernisation and digitalisation of trade documentation which can have positive spillovers for tax administration more generally.

As these various mechanisms suggest, the relationship between trade and tax performance is complex and inherently endogenous. We employ a reduced-form instrumental variable analysis that addresses this endogeneity to tease out estimates of the causal effect of trade on tax performance. The context for the above mechanisms is usually one of trade expansion and liberalisation. We apply our findings to try to understand the possible effects of the current trend toward trade contraction and restriction on tax performance.

Of course, besides international trade, other country-level factors can influence a nation's tax performance. If these factors are correlated with trade openness, omitting them from the analysis could bias our estimates. Therefore, we include the following variables as controls in our regressions. While the inclusion of these variables is for the purpose of obtaining unbiased estimates of the causal effect of international trade on the tax ratio, for completeness, we discuss their theoretical relationships with the tax ratio below. A full list of variables used in our analysis along with the data sources is given in Table 1 (Appendix).

1. *GDP per capita* (+): higher income levels generally expand the tax base through multiple channels. Wealthier economies typically have larger formal sectors, more sophisticated financial systems, and greater administrative capacity to enforce tax compliance. We therefore expect a positive coefficient on this variable.

2. *Agricultural share of GDP* (−): agriculture poses challenges for tax collection, particularly in developing economies. The sector often consists of numerous

small, informal producers that are difficult to monitor and tax effectively. Agricultural products also frequently receive preferential tax treatment for food security and distributional concerns. We anticipate a negative relationship between agricultural share and tax performance.

3. *Education level* (+): education can influence tax performance through multiple channels. Better-educated populations may have higher tax morale and better understanding of the tax system, increasing compliance. Education also correlates with higher-skilled employment in the formal sector, which is more easily taxed than informal activities. We expect a positive coefficient on education measures.

4. *Tax rate* (−/+): the effect of statutory tax rates on revenue collection is theoretically ambiguous. Higher rates increase revenue collection mechanically if the tax base remains constant. However, excessive rates may encourage evasion, avoidance, or reduced economic activity, potentially decreasing the tax base. We include this variable primarily as a control without a strong directional hypothesis.

5. *Tax compliance burden* (−): complex tax systems with high compliance costs discourage formal sector participation and facilitate evasion. We expect a negative relationship between compliance burden measures and tax performance.

6. *Population growth* (−): rapid population growth often strains administrative capacity, particularly in developing countries. Fast-growing populations may outpace the expansion of tax administration resources, potentially reducing collection efficiency. We expect a negative coefficient on this variable.

7. *Working age population* (+): a larger proportion of working-age individuals in the population should expand the tax base, particularly for income and payroll taxes. We anticipate a positive relationship with tax performance.

8. *Institutional quality* (+): strong institutions are fundamental to effective tax collection. We expect a positive coefficient on measures of institutional quality.

For our estimates of the effect of international trade on tax inefficiency, we also include in our regressions control variables that might be correlated with both trade and tax inefficiency and bias the estimates if omitted:

1. *Size of shadow economy* (+): activities in the shadow economy make tax collection more difficult.

2. *Corruption* (+): corruption makes tax collection more difficult.

3. *Population growth rate* (+): it is more difficult to administer a rapidly growing population of taxpayers.

3. METHODOLOGY: ESTIMATING THE EFFECT OF TRADE ON TAX RATIO AND TAX INEFFICIENCY

The focus of this article is on quantifying the causal relationship between international trade and tax performance across countries. We employ two complementary methodological approaches to examine this relationship. First, we estimate the causal

effect of international trade on the tax ratio (tax revenue as a percentage of GDP) using instrumental variable regression techniques.

This approach addresses the inherent endogeneity between trade openness and tax systems by identifying exogenous geographical determinants of bilateral trade flows. Second, we utilise stochastic frontier analysis to estimate the effect of international trade on tax efficiency – the degree to which countries achieve their tax revenue potential given their economic and structural characteristics.

We first examine the relationship between a country's exposure to international trade and its tax ratio. The baseline model we estimate takes the following form:

$$\ln(T_i) = \beta_0 + \ln(Trade_i) + \Sigma\ \beta_i z_i + v_i \quad (1)$$

where $ln(T_i)$ represents the natural log of the tax ratio for country *i* defined as tax revenue as a percentage of GDP, $Trade_i$ is exports plus imports as a percentage of GDP, z_i represents a vector of country-level control variables which we detailed in the previous section. v_i is a random error term accounting for exogenous shocks, assumed to be independently normally distributed.

3.1 Estimating the effect of international trade on the tax ratio: constructing the instrument

The relationship between trade openness and tax performance is inherently endogenous, creating challenges in identifying causal effects. Several mechanisms drive this endogeneity. For example, countries with more efficient tax systems may be better positioned to liberalise trade by having alternative revenue sources to replace declining tariffs. Conversely, countries heavily dependent on trade taxes may resist liberalisation to protect fiscal revenues. Additionally, unobserved factors such as institutional quality simultaneously affect both trade policy and tax collection capacity – well-functioning institutions tend to promote both trade openness and effective taxation. Even the direction of causality is ambiguous: while trade may enhance tax performance through economic growth, countries with stronger fiscal systems may more readily engage in international trade due to better infrastructure and administrative capabilities funded by tax revenues. These complex bidirectional relationships necessitate an identification strategy that isolates the causal effect of trade on tax performance.

To address this endogeneity, we construct an instrumental variable for trade openness based on the level of bilateral trade predicted from exogenous geographical variables in a gravity model regression. This approach was first introduced by Frankel and Romer (1999) to study the effect of trade on income. The most basic gravity model of international trade posits that bilateral trade flows between countries are proportional to their economic sizes and inversely related to the distance between them. The expanded gravity regression we apply here takes the following form:

$$\ln \text{Trade}_{ij} = \beta_0 + \beta_1 \ln D_{ij} + \beta_2 \ln N_i + \beta_3 \ln A_i + \beta_4 \ln N_j + \beta_5 \ln A_j + \beta_6 L_{ij} + \beta_7 B_{ij} + \beta_8 B_{ij} \ln D_{ij} + \beta_9 B_{ij} \ln N_i + \beta_{10} B_{ij} \ln A_i + \beta_{11} B_{ij} \ln N_j + \beta_{12} B_{ij} \ln A_j + \beta_{13} B_{ij} L_{ij} + e_{ij} \quad (2)$$

where $Trade_{ij}$ is bilateral trade between countries i and j measured as exports plus imports divided by GDP for country i in year 2021, D_{ij} is the distance between countries i and j, N is population (in thousands), A is area (in km^2), L_{ij} is a dummy for common language countries, B_{ij} is a dummy variable for a common border between the two countries. Below is a discussion of these exogeneous variables and the expected theoretical relationship to trade openness:

1. D_{ij}, *Distance between countries* (−): geographic distance increases transportation costs and information frictions, thereby reducing trade intensity. We expect a negative coefficient on this variable, with the magnitude of trade declining as distance increases.

2. B_{ij}, *Shared border* (+): countries sharing a land border typically experience enhanced trade due to lower transportation costs and increased opportunities for market integration. We expect a positive coefficient on this dummy variable.

3. L_{ij}, *Common language* (+): a shared language reduces communication barriers and transaction costs while facilitating business relationships. We anticipate a positive coefficient on this variable.

4. *A, Country land area* (−/+): the relationship between land area and trade intensity is complex. Countries with larger land areas tend to have more diverse resources and larger domestic markets, reducing their need for international trade (−). However, larger economies may also have greater capacity to engage in international trade through economies of scale in production (+).

5. *N, Country population* (−/+): population size similarly has competing effects on trade intensity. Countries with larger populations have larger domestic markets, potentially reducing their reliance on international trade (−). Conversely, more populous countries may benefit from economies of scale in production, allowing them to specialise and export more efficiently (+).

Since we are interested in using this regression as a prediction model, we also include interactions of the variables to better predict trade. The regression estimate is used to predict trade between two countries. Then, for each country i in the sample, we sum the predicted bilateral trade over all trading partners to obtain one constructed trade share for country i. This we use as the instrument for actual trade share. For robustness, because many country pairs have zero trade flows, we also estimate the gravity regressions above using a Poisson pseudo-maximum likelihood estimator with trade share as the outcome variable. As we show in the next section, the results are not that different from the ordinary least squares (OLS) estimates using log trade share. We thus use the OLS estimates for the construction of the instrumental variable.

We also explore the effects of international trade on the tax ratio for different country types by breaking the sample into different groups. We defined a country as ‘non-rich’ if it had GDP per capita below USD 10,000 in 2021. Low- and middle-income countries might be more sensitive to changes in the trade regime as international trade is a bigger

share in the economies. It is also possible that the exports and imports do not affect a country's tax performance symmetrically. To examine this possibility, we define the country as a 'net export' country if the value of its exports exceeds the value of its imports. Finally, the mode of tax administration might also affect the relationship of tax performance and trade. A country is an 'indirect tax type' country if revenue from indirect taxes exceeds that from direct taxes. We include these dummy variables in the regressions and also their interactions with the trade variable.

3.2 Studying tax inefficiency and trade using stochastic frontier analysis

As a second exercise, we estimate the effect of trade and other factors on a country's tax inefficiency using a stochastic frontier model. First, we use the estimates of equation 1 to predict a maximum tax revenue a country could collect conditional on the country characteristics. The stochastic frontier model assumes that the observed tax ratio has two random components, an exogenous shock assumed normally distributed and a second random term representing inefficiency of the tax collection system. That is:

$$\ln(T_i) = \beta_0 + \Sigma\ \beta_i z_i + v_i - u_i \qquad (3)$$

where:

- T_i represents the tax ratio for country i,
- z_i represents the vector of explanatory variables including trade,
- v_i is the random error term accounting for exogenous shocks, assumed to be identically normally distributed,
- u_i represents inefficiency, where $u_i \geq 0$, and two alternative distributional assumptions are considered:
  - Half-normal distribution: $u_i \sim N+(0, \sigma^2)$,
  - Exponential distribution: $u_i \sim Exp(\sigma^2)$.

A country's tax effort is defined as the ratio of the actual tax ratio to its potential tax ratio – defined as the maximum another country with similar characteristics can achieve. The negative of the log-transform of Tax Effort (*TE*) is then its Tax Inefficiency, ($\ln TE = -u_i$). Thus, tax inefficiency can be calculated given the assumption on the distribution of u_i.

In the second step, we regress tax inefficiency on a set of explanatory variables to estimate its determinants including trade:

$$u_i = \sum \gamma_i \omega_i + \xi_i$$

where:

- ω_i includes trade, control of corruption, voice and accountability, size of the shadow economy, and tax compliance burden,
- γ_i represents the coefficients to be estimated, and
- ξ_i is the error term.

The study uses cross-sectional data from 2021 obtained from several international sources, as shown in Table 1 (Appendix).

4. RESULTS

4.1 Trade and tax ratios: instrumental variable results

Table 2 shows descriptive statistics for variables used in the gravity model estimations. Since many countries do not trade with each other leaving zero for the trade share variable, in addition to the OLS estimates using log of trade share as our trade variable, we also estimate the gravity model using Poisson pseudo-maximum likelihood (PPML) without the log transformation. See also Table 3. Results are shown in Table 4.

Table 2: Descriptive Statistics for Trade Determinants Regressions

Variable	Obs	Mean	Std. Dev.	Min	Max
lntradeshare	15,779	-3.523	2.954	-16.294	5.273
lnarea	21,609	11.660	2.447	3.989	16.611
lnpop	21,609	9.130	1.938	3.981	14.161
lndist	21,609	8.647	0.859	1.792	9.894
comlang	21,609	0.141	0.348	0	1
contig	21,609	0.020	0.141	0	1

Table 3: The Bilateral Trade Equation

	Variable	Interaction
Ln area (country i)	-0.101***	-0.0135
	(0.0133)	(0.0867)
Ln area (country j)	-0.221***	0.0778
	(0.0130)	(0.0897)
Ln population (country i)	0.0886***	-0.527***
	(0.0164)	(0.0932)
Ln population (country j)	1.067***	-0.447***
	(0.0155)	(0.0821)
Ln distance	-1.220***	0.903***
	(0.0219)	(0.176)
Common language	0.218***	-0.527***
	(0.0575)	(0.161)
Common border	4.162***	
	(0.729)	
Constant	-0.176	
	(0.213)	
Observations	15,779	
R-squared	0.412	

The dependent variable is the log of imports plus exports as a share of GDP. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4: The Extended Bilateral Trade Equation

	(1) OLS Full Sample	(2) PPML Full Sample	(3) OLS Ex. Singapore & HK	(4) PPML Ex. Singapore & HK
Ln area (country i)	-0.0381*	-0.0438	0.00616	0.0406
	(0.0216)	(0.0381)	(0.0101)	(0.0275)
Ln area (country j)	-0.0828***	-0.0813**	-0.0749***	-0.0894**
	(0.00910)	(0.0387)	(0.00804)	(0.0378)
Ln population (country i)	0.00483	-0.0642	-0.0372***	-0.148***
	(0.0217)	(0.0436)	(0.0132)	(0.0350)
Ln population (country j)	0.320***	0.766***	0.295***	0.762***
	(0.0198)	(0.0276)	(0.0136)	(0.0266)
Ln distance	-0.303***	-0.654***	-0.309***	-0.676***
	(0.0247)	(0.0679)	(0.0227)	(0.0719)
Common language	0.187***	0.258**	0.100*	0.143
	(0.0672)	(0.106)	(0.0515)	(0.106)
Common border	3.929***	1.162***	3.519***	1.087***
	(0.606)	(0.151)	(0.421)	(0.140)
Constant	1.401***	-1.288***	1.447***	-1.177**
	(0.249)	(0.473)	(0.224)	(0.472)
Observations	21,609	21,609	21,315	21,315
R-squared	0.119	0.158	0.145	0.097

The dependent variable is log of imports plus exports as a share of GDP. Data are from 2021. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

For the full sample, the OLS and PPLM estimates are of similar magnitude with signs on the coefficient estimates. Larger countries in terms of land area tend to trade less. Countries tend to trade more with more populous countries. Countries that share a border or a common language trade more with each other while distance reduces trade between countries. We repeat the estimates omitting Hong Kong and Singapore from the sample. Hong Kong was historically an intermediary economy while Singapore is characterised as a port economy whose trade might not depend as much on these geographical factors. Hong Kong was also of course under Chinese rule in 2021. The estimates omitting Hong Kong and Singapore are not qualitatively different from the results using the full sample.

We are not interested in the interpretation of the coefficient estimates per se. We instead use these estimates to predict the volume of trade between two countries. Then for each country, we aggregate over all trading partners to arrive at a constructed trade share for each country. This variable is determined by arguably exogenous factors. To use it as an instrument for our analysis of trade effects on tax performance, we must assume that these exogenous variables only affect tax performance by way of trade (that is, it satisfies the exclusion restriction). We include control variables in the analysis that can account for any relationships that are present outside of the trade channel.

Figure 2 shows that constructed trade share and actual trade share are strongly positively correlated. The relationship is still highly significant even after controlling for a

country's population and land area. Variation in constructed trade share explains about 35% of the variation in actual trade share. These results are shown in Table 5.

Fig. 2: Constructed versus Actual Trade Share

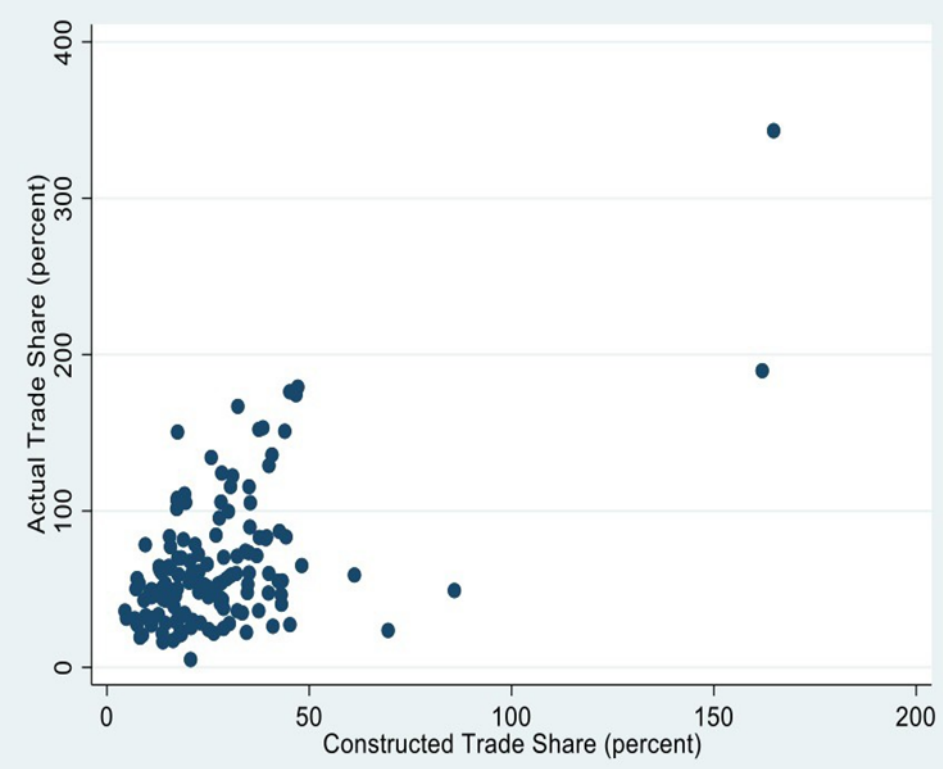


Table 5: The Relation between Actual and Constructed Overall Trade

	(1)	(2)	(3)
Constructed trade share	1.263***		1.554***
	(0.287)		(0.314)
Ln population		1.067	-10.57***
		(4.588)	(2.732)
Ln area		-4.607	7.409***
		(4.363)	(2.023)
Constant	31.00***	109.0***	33.26**
	(6.959)	(22.85)	(16.75)
Observations	147	147	147
R-squared	0.347	0.049	0.410

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6 shows the results of regressions of trade and the tax ratio. For the OLS estimates, a 4% increase in international trade is associated with over 1% increase in the tax ratio. This result holds for specifications controlling for neoclassical factors such as capital investment, labour force, education, size of the agriculture sector and GDP per capita. We also added controls for the tax rate and the tax compliance burden, and a measure of institutional quality, namely, voice and accountability.

Table 6: Tax Ratio and Trade: OLS and IV Estimates

VARIABLES	OLS	IV	OLS	IV	OLS	IV
lnTRADE	0.282**	0.180	0.287***	0.221	0.281***	0.399*
	(0.108)	(0.204)	(0.108)	(0.224)	(0.083)	(0.205)
lnTRate			-0.025	0.044	-0.174	-0.294
			(0.336)	(0.430)	(0.257)	(0.335)
lnTCB			0.116	0.038	0.261	0.397
			(0.383)	(0.496)	(0.301)	(0.388)
lnGDPpc	0.155	0.177	0.154	0.168	0.068	0.044
	(0.118)	(0.120)	(0.119)	(0.122)	(0.108)	(0.110)
lnAGR	0.077	0.075	0.067	0.067	0.080	0.081
	(0.074)	(0.066)	(0.076)	(0.069)	(0.063)	(0.066)
lnK	0.020	0.009	0.013	0.007	0.019	0.030
	(0.025)	(0.029)	(0.025)	(0.027)	(0.026)	(0.027)
lnWKAGE	-2.081***	-2.134***	-1.972***	-2.012***	-1.600**	-1.534**
	(0.683)	(0.671)	(0.676)	(0.661)	(0.615)	(0.613)
lnEDU	1.007***	1.029***	0.996***	1.010***	0.957***	0.933***
	(0.306)	(0.294)	(0.297)	(0.287)	(0.259)	(0.264)
lnVA					0.247***	0.243***
					(0.091)	(0.082)
Constant	8.814***	9.485***	8.184***	8.659***	6.405**	5.584*
	(3.096)	(3.210)	(3.038)	(3.274)	(2.882)	(3.040)
Observations	109	109	109	109	109	109
R-squared	0.492	0.482	0.496	0.492	0.555	0.541

The dependent variable is a country's tax ratio. Data are for 2021.
Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Results from the instrumental variable regressions are more mixed. In specifications controlling for the neoclassical variables, the tax rate and tax compliance burden, point estimate is similar to that in the OLS estimate but are not statistically significant. But when we include the full set of control variables, the estimate is highly significant and the magnitude larger than the OLS estimate. A 2.5% increase in the trade share causes a 1% increase in the tax ratio.

In Table 7 (Appendix), we show results for the effects of international trade on tax ratio for different country types. We defined a country as 'non-rich' if it has GDP per capita below USD 10,000 in 2021. We define the country as a 'net export' country if the value of its exports exceeds the value of its imports. A country is an 'indirect tax type' country if revenue from indirect taxes exceed that from direct taxes. Inclusion of these dummy

variables and their interactions with the trade share variable does decrease the magnitude of the point estimate of the coefficient on the trade share variable but not by much in the case of the non-rich/rich dichotomy. As seen in the positive coefficients on the interaction term between non-rich and trade in both the OLS and IV results, the effect of trade on the tax ratio is bigger for non-rich countries in the sample though the difference is not statistically significant. We do not find that the effect of trade on tax performance is consistently different for net exporting versus net importing countries. Unlike these results, the effect of trade on tax performance is no longer significant when we include classifications of the countries by indirect versus direct tax type. This could be because the sample reduces to under 100 countries because data are not available.

4.2 Trade and tax inefficiency: stochastic frontiers analysis results

Table 8 (Appendix) presents the results estimating the determinants of tax ratio in Stochastic Frontier models with both half-normal and exponential distributions for the inefficiency term u_i. The explanatory variables include trade openness (lnTRADE), tax rates (lnTRate), tax compliance burden (lnTCB), GDP per capita (lnGDPpc), agriculture's share of GDP (lnAGR), and education levels (lnEDU), along with institutional variables like Voice and Accountability (lnVA). Additionally, models (d), (e), and (f) incorporate predicted trade (lnPredictedTRADE), instrumented from a gravity model to control for potential endogeneity in trade. See also Table 9 (Appendix).

A key finding across all models is that trade openness, both actual and predicted, is significant in increasing the tax ratio. In models (a), (b), and (c), lnTRADE is positively and significantly related to the tax ratio, indicating that greater trade openness is associated with higher ability for a country to collect taxes efficiently. When predicted trade is used in models (d), (e), and (f), the positive relationship remains, albeit with slightly diminished significance, confirming that trade continues to be a crucial factor in improving tax performance, even after accounting for endogeneity.

Institutional quality, captured by Voice and Accountability (lnVA), consistently shows a positive and significant relationship with tax efficiency. Education appears to have the most robust impact across all models, suggesting that better human capital development enhances the efficiency of tax collection. Voice and Accountability also play a role, though its significance diminishes when predicted trade is included, suggesting some overlap in how these factors affect tax performance.

Other variables like GDP per capita and the agriculture share of GDP present more mixed results. The negative and significant relationship between lnAGR and tax efficiency in model (a) suggests that a larger agricultural sector leads to higher inefficiency, but this effect is not consistent across all models. Similarly, the coefficient for GDP per capita fluctuates, being significant in some models but insignificant in others, which may indicate that its impact on tax efficiency is more context dependent.

Overall, the results highlight the importance of international trade and institutional quality as critical drivers of tax efficiency. While higher tax rates and tax compliance burdens tend to reduce efficiency, the presence of robust trade openness and strong institutional frameworks can mitigate these negative effects. These findings indicate the significance of fostering trade and improving governance structures to enhance tax performance, particularly in developing and emerging markets.

Based on the estimates above, we present in Table 9 (Appendix) the implied Tax Ratio and Tax Effort for various countries based on two different models: model (b), which uses actual trade data, and model (e), which uses predicted trade data obtained from the gravity model.

The Tax Effort columns from model (b) and model (e) measure how much tax a country collects relative to its potential capacity or estimated potential. Following our earlier definition, tax effort serves as an indicator of tax efficiency, with lower tax effort scores implying greater tax inefficiency. However, it is important to distinguish between low tax effort due to structural inefficiencies in tax administration and low tax effort that results from deliberate policy choices.

According to model (b), which is based on actual trade data, several countries, including Brazil (93.99%), France (93.49%), and Denmark (92.05%), demonstrate high tax effort. These rankings indicate that these countries collect close to their estimated tax potential, which may suggest high efficiency in revenue mobilisation. However, tax effort does not necessarily equate to institutional effectiveness or governance quality – it reflects how much tax a country collects relative to its estimated potential, regardless of the underlying reasons.

The tax rate (lnTRate) shows a consistent negative effect on tax ratio in models (a), (b), and (c), implying that higher tax rates reduce efficiency. However, when predicted trade is introduced, this effect becomes insignificant, suggesting that trade may mitigate the negative impact of higher tax rates. Similarly, the tax compliance burden (lnTCB) has a positive relationship with tax inefficiency in models (b) and (c), but this effect becomes insignificant once predicted trade is accounted for, indicating that trade might reduce the burden of inefficiencies arising from complex tax compliance.

When switching to model (e), which incorporates predicted trade to account for trade endogeneity, we observe some shifts in tax effort estimates. For instance, Greece and Albania show reductions in their tax effort, suggesting that incorporating predicted trade data might alter the perceived efficiency of their tax collection systems. Conversely, Belgium's tax effort rises significantly from 75.90% to 86.34%, indicating that its tax capacity may be higher than previously estimated when accounting for trade potential.

The Tax Ratio (TRatio) offers insight into how much tax revenue a country collects relative to the size of its economy. Countries such as Denmark, France, and Finland exhibit high tax ratios, indicating that they collect a significant portion of their GDP as taxes. These countries are typically developed economies with efficient tax collection systems and higher levels of compliance. On the other hand, developing countries like Nigeria, Angola, and Bangladesh tend to have lower tax ratios, which suggests weaker tax systems, lower tax compliance, or less efficient mechanisms for tax collection.

For countries such as Switzerland and the United States, their tax effort remains relatively low across both models (Switzerland: 61.83% in model (b) vs. 66.88% in model (e); the US: 78.98% in model (b) vs. 74.64% in model (e)). However, this does not necessarily reflect tax inefficiency. Instead, these countries have relatively low tax ratios (Switzerland: 28.61%, US: 26.82%) primarily due to policy choices that favour lower taxation rather than an inability to collect more revenue. Model (e)'s slight increase in Switzerland's tax effort suggests that its trade-adjusted tax potential is somewhat higher, but the country still maintains a low-tax policy approach.

Interestingly, some countries maintain high tax effort across both models, such as Lesotho (94.71% in model (b) and 95.02% in model (e)) and Nicaragua (94.20% in model (b) and 93.91% in model (e)). However, a high tax effort does not necessarily indicate an exemplary tax system. Countries like Nicaragua may have high tax effort scores because they collect close to or even above their estimated tax capacity, despite facing significant institutional challenges such as weak administrative efficiency or high levels of informality. This suggests that while these countries are extracting a high share of their potential revenue, it may come at the cost of economic distortions or over-reliance on specific tax sources. On the other hand, countries like Mexico and Indonesia exhibit lower tax effort across both models (Mexico: 41.76% in model (b) vs. 53.23% in model (e); Indonesia: 37.44% in model (b) vs. 37.19% in model (e)). This implies that they are not fully utilising their tax base, and there is room for improvement in their tax systems. However, the increase in Mexico's tax effort under model (e) indicates that its estimated tax potential rises when considering trade endogeneity, potentially implying a structural underperformance rather than an entirely inefficient tax system.

Other studies also report comparable patterns. For example, the World Bank study by Le, Moreno-Dodson and Bayraktar (2012) and the IMF study by Fenochietto and Pessino (2013) both find similar results, with Switzerland exhibiting a low tax effort despite having a highly efficient tax administration. Langford and Ohlenburg (2015) similarly found that countries like Switzerland tend to exhibit low tax effort despite strong institutions, while Zimbabwe shows high tax effort but low tax ratios. Additionally, Mawejje and Sebudde (2019), using a different methodology to estimate tax capacity and effort, arrive at similar rankings – Switzerland consistently exhibits low tax effort, while Zimbabwe ranks high. These findings reinforce that our results are not anomalies but align with established research on tax effort estimation.

Table 10 presents the results from analysis of tax inefficiency (i.e., u_i) using different models and distributional assumptions for the inefficiency term u_i in the first step of the analysis. The explanatory variables include the size of the shadow economy (lnSHADOW), population growth (POPGR), control of corruption (lnCC), and an interaction term between control of corruption and the shadow economy (lnCC × lnSHADOW). The models compare actual trade data (columns a, b, c) and predicted trade data (columns d, e, f), with both half-normal and exponential distributions for the inefficiency term.

Table 10: Explaining Tax Inefficiency

	Model (a)	Model (b)	Model (c)	Model (d)	Model (e)	Model (f)
lnSHADOW	-0.404	-0.406	-0.798	-0.335	-0.343	-0.670
	(0.619)	(0.570)	(0.604)	(0.682)	(0.628)	(0.656)
POPGR	-0.065**	-0.072**	-0.085***	-0.032	-0.041	-0.055*
	(0.031)	(0.028)	(0.030)	(0.034)	(0.031)	(0.033)
lnCC	-0.108	-0.102	0.004	-0.112	-0.105	-0.011
	(0.151)	(0.140)	(0.148)	(0.166)	(0.153)	(0.161)
lnCCxlnSHADOW	0.084	0.077	0.168	0.074	0.068	0.145
	(0.141)	(0.130)	(0.138)	(0.155)	(0.143)	(0.149)
lnTRADE	-0.283***	-0.260***	-0.248***			
	(0.063)	(0.058)	(0.061)			
lnTRADE_h				-0.060	-0.056	-0.045
				(0.075)	(0.069)	(0.073)
Constant	1.995***	1.737***	1.273*	1.072	0.893	0.495
	(0.662)	(0.610)	(0.642)	(0.707)	(0.651)	(0.680)
Observations	102	102	103	102	102	103
R-squared	0.251	0.237	0.203	0.097	0.082	0.069

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The Table highlights significant variation in tax effort across countries, with developed economies typically showing higher tax ratios and tax effort, while developing nations struggle with lower efficiency in tax collection. However, this variation must be interpreted carefully. A lower tax effort does not always indicate tax inefficiency – it can also reflect policy preferences, as seen in Switzerland and the US. Similarly, a high tax effort score does not automatically imply an effective tax administration, as seen in cases where countries mobilise revenues at levels near or exceeding their estimated potential due to external economic pressures. The introduction of predicted trade data in model (e) slightly alters the tax effort estimates for some countries, highlighting the importance of considering trade endogeneity when assessing tax efficiency.

Similarly, while the shadow economy (lnSHADOW) consistently shows a negative coefficient across all models, suggesting that a larger shadow economy might reduce tax inefficiency – this effect remains statistically insignificant. Likewise, control of corruption (lnCC) is negatively associated with tax inefficiency in most models but lacks statistical significance.

Overall, the relatively low R-squared values (ranging from 0.069 to 0.251) indicate that other unobserved factors likely influence tax inefficiency. While this analysis provides some insights, we acknowledge its limitations and suggest that further research could explore additional determinants of tax inefficiency.

One notable finding is the effect of population growth (POPGR). In several models, including columns (a), (b), (c), and (f), population growth is associated with a reduction in tax inefficiency. This suggests that higher population growth may lead to more efficient tax collection, possibly because a growing population increases the need for improved public services, prompting governments to enhance tax administration systems. However, this relationship does not appear in models (d) and (e), likely

reflecting differences in the underlying trade measures rather than a fundamental contradiction. The variation in results suggests that the estimated effect of population growth may be sensitive to econometric assumptions and data sources rather than pointing to a clear theoretical mechanism.

5. CONCLUSION

This article examines the relationship between international trade and tax performance using cross-country data. Our analysis, which addresses the endogeneity of trade and taxation outcomes through an instrumental variable constructed using geographical determinants, provides strong evidence that trade openness positively affects both tax revenue and tax efficiency. These findings are robust across different model specifications and remain significant after controlling for various economic, institutional, and policy factors.

We do acknowledge that unobserved institutional factors, such as federalism, governance structures, and the size of the informal economy, may influence tax effort estimates in ways not fully captured by our models. While we control for key structural determinants, tax effort remains an estimation subject to data constraints. Future research could explore these dimensions further to refine our understanding of cross-country variations in tax performance.

Looking forward, several questions deserve further research attention. How might different types of trade relationships (e.g., regional trade agreements versus broader multilateral engagement) affect tax performance? How might the interaction between trade and tax performance change as countries move away from rules-based multilateral arrangements toward more fragmented bilateral trading relationships? How might countries address fiscal constraints if tax performance is adversely affected in a less-integrated world?

Our findings and these questions have important implications given current trends toward de-globalisation and economic fragmentation. The retreat from global trade integration could pose significant fiscal challenges, particularly for developing economies that rely heavily on trade-related revenue and benefit from trade's institutional spillovers. Our results suggest that the impact may extend beyond the direct effect of reduced trade volumes to include broader consequences for tax administration efficiency and institutional development.

6. REFERENCES

Baunsgaard, T & Keen, M 2010, 'Tax revenue and (or?) trade liberalization', *Journal of Public Economics*, vol. 94, nos 9-10, pp. 563-577.

Fenochietto, R & Pessino, C 2013, 'Understanding countries' tax effort', International Monetary Fund Working Paper WP/13/244, Washington, DC.

Frankel, J A & Romer, D H 1999, 'Does trade cause growth?', *American Economic Review*, vol. 89, no. 3, pp. 379-399.

Hines, J R, Jr 2007, 'Corporate taxation and international competition', in Auerbach, A J, Hines, J R, Jr & Slemrod, J (eds), *Taxing corporate income in the 21st century*, Cambridge University Press, Cambridge, pp. 268-295.

Holzner, M, Jovanović, B & Vukšić, G 2021, 'How do corporate taxes affect international trade?', Vienna Institute for International Economic Studies Working Paper 212, Vienna, November.

Khattry, B & Rao, J M 2002, 'Fiscal faux pas?: An analysis of the revenue implications of trade liberalization', *World Development*, vol. 30, no. 8, pp. 1431-1444.

Langford, B & Ohlenburg, T 2015, 'Tax revenue potential and effort: An empirical investigation', International Growth Centre Working Paper, London.

Le, T M, Moreno-Dodson, B & Bayraktar, N 2012, 'Tax capacity and tax effort: Extended cross-country analysis from 1994 to 2009', World Bank Policy Research Working Paper 6252, Washington, DC.

Leonard, J 2024, 'In Trump's economic plan, tariff is "the most beautiful word"', *Bloomberg News*, 16 October, https://www.bloomberg.com/news/newsletters/2024-10-15/in-trump-s-economic-plan-tariff-is-the-most-beautiful-word (accessed 8 May 2025).

Mawejje, J & Sebudde, R K 2019, 'Tax revenue potential and effort: Worldwide estimates using a new dataset', *Economic Analysis and Policy*, vol. 63, pp. 119-129.

Medina, L & Schneider, F 2018, 'Shadow economies around the world: What did we learn over the last 20 years?', International Monetary Fund Working Paper WP/18/17, Washington, DC.

Morrissey, O, von Haldenwang, C, von Schiller, A, Ivanyna, M & Bordon, I 2016, 'Tax revenue performance and vulnerability in developing countries', *Journal of Development Studies*, vol. 52, no. 12, pp. 1689-1703.

Slemrod, J 2004, 'Are corporate tax rates, or countries, converging?', *Journal of Public Economics*, vol. 88, no. 6, pp. 1169-1186.

Tran-Nam, B & Le, T-H 2022, 'Potential tax ratio, tax effort and tax inefficiency in the OECD: An empirical study using the stochastic tax frontier model', *Australian Tax Forum*, vol. 37, no. 2, pp. 193-226.

7. APPENDIX

Table 1: Variables, Descriptions, and Sources

Variable	Description	Data source
International Trade, *Trade*	Exports + Imports (% of GDP)	IMF
Distance, *D*	Distance between two countries	Centre d'Études Prospectives et d'Informations Internationales
Area, *A*	Land Area of a country (km^2)	World Development Indicators
Size of shadow economy, *SHADOW*	as % of GDP	Medina and Schneider (2018)
Common Language, *L*	Dummy with value equal 1 for Country Pairs with common language	Centre d'Études Prospectives et d'Informations Internationales
Common Border, *B*	Dummy with value equal 1 for Country Pairs with common border	Centre d'Études Prospectives et d'Informations Internationales
Tax ratio, *T*	Tax revenue as % of GDP	OECD Data
Tax compliance burden, *TCB*	Time to prepare and pay taxes (hours)	Paying Taxes (PwC)
Tax rate, *Trate*	Total tax and contribution rate (% of profit)	Paying Taxes (PwC)
GDP Per capita. *GDPpc*	GDP per capita, PPP (current international $)	OECD Data

Agriculture, *AGR*	Agriculture, forestry, and fishing, value added (% of GDP)	OECD Data
Population, *N*	Population	World Development Indicators
Population growth, *POPGR*	Population growth (annual %)	World Development Indicators
Working age population, *WKAGE*	% of total population	OECD Data
Inflation, *INF*	Consumer price inflation (annual %)	World Development Indicators
Institutional quality, *VA*	Voice and Accountability: Percentile rank, with higher scores corresponding to better outcomes	World Governance Indicators
Corruption, *CC*	Control of Corruption: higher scores correspond to better outcomes	World Governance Indicators
Education, *EDU*	Education Index: Measures adult literacy and combined gross enrolment	UNDP Human Development Reports
Capital Investment, *K*	Gross fixed capital formation (million US dollars)	OECD Data

Table 7: Tax Ratio and Trade: Results for Different Types of Countries

	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
lnTRADE	0.367***	0.338	0.248*	0.299*	0.393***	0.121	0.158	0.250
	(0.084)	(0.211)	(0.126)	(0.179)	(0.093)	(0.489)	(0.204)	(0.410)
nonRich			-1.342**	-0.756				
			(0.630)	(2.317)				
TradenonRich			0.257	0.107				
			(0.156)	(0.606)				
NET_ex					0.227	-1.097		
					(0.663)	(2.170)		
TradeNetEx					-0.047	0.284		
					(0.161)	(0.547)		
IndirectTaxType							-1.016	-0.219
							(0.929)	(2.053)
TradeIndirectTaxType							0.256	0.062
							(0.222)	(0.502)
Constant	1.553***	1.673**	2.142***	1.932***	1.435***	2.516	2.438***	2.057
	(0.341)	(0.841)	(0.528)	(0.727)	(0.376)	(1.930)	(0.847)	(1.685)
Observations	120	120	120	120	120	120	97	97
R-squared	0.176	0.175	0.282	0.277	0.178	0.138	0.141	0.130

The dependent variable is a country's tax ratio. Data are for 2021.
Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 8: Tax Ratio and Trade: Stochastic Frontier Model Results

Variables	(a) Half-normal distribution u_i	(b) Exponential distribution u_i	(c) Half-normal distribution u_i	(d) Half-normal distribution u_i	(e) Exponential distribution u_i	(f) Half-normal distribution u_i
lnTRate	-0.948***	-0.416**	-0.345*	-0.185	-0.173	-0.137
	(0.000)	(0.181)	(0.181)	(0.370)	(0.142)	(0.167)
lnTCB	1.082	0.480**	0.401*	0.219	0.244	0.200
	(0.000)	(0.222)	(0.225)	(0.341)	(0.204)	(0.231)
lnGDPpc	-0.058***	0.057	0.488	0.021	0.076	0.868
	(0.000)	(0.103)	(0.481)	(0.223)	(0.121)	(0.647)
lnGDPpc2			-0.015			-0.034
			(0.024)			(0.032)
lnAGR	-0.035***	-0.009	-0.019	-0.006	0.001	-0.034
	(0.000)	(0.071)	(0.062)	(0.149)	(0.089)	(0.073)
lnTRADE	0.297***	0.240***	0.224***			
	(0.000)	(0.074)	(0.077)			
lnPredictedTRADE				0.048	0.091	0.101
				(0.152)	(0.107)	(0.075)
lnK	0.015***	0.017	0.004	-0.000	-0.005	-0.016
	(0.000)	(0.020)	(0.019)	(0.020)	(0.019)	(0.021)
lnWKAGE	-0.404***	-0.613	-0.111	-0.671	-0.735	-0.277
	(0.000)	(0.610)	(0.656)	(0.919)	(0.657)	(0.750)
lnEDU	1.085***	0.685***		0.849***	0.767***	
	(0.000)	(0.209)		(0.253)	(0.260)	
lnVA	0.132***	0.113*	0.094*	0.138	0.134	0.118
	(0.000)	(0.062)	(0.057)	(0.107)	(0.097)	(0.081)
USigma Constant	-0.927***	-2.031***	-1.895***	-0.993*	-2.034***	-1.905***

	(0.132)	(0.306)	(0.286)	(0.574)	(0.463)	(0.308)
VSigma Constant	-23.356***	-3.877***	-3.793***	-4.321*	-3.543***	-3.524***
	(0.252)	(0.565)	(0.514)	(2.518)	(0.759)	(0.482)
Observations	109	109	110	109	109	110
Sigma(u)	0.629	0.362	0.388	0.609	0.362	0.386
Sigma(v)	8.48e-06	0.144	0.150	0.115	0.170	0.172
Lambda	74220	2.516	2.583	5.279	2.127	2.246
Log-Likelihood	-28.61	-34.16	-41.14	-41.25	-40.08	-

The dependent variable is a country's tax ratio. Data are for 2021.
Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 9: Average Tax Ratios and Tax Effort

Country	Tax Ratio (%)	Tax Effort (%) using Model (b)	Tax Effort (%) using Model (e)
Albania	24.74	81.75	78.01
Angola	22.65	87.09	88.78
Argentina	29.08	85.31	81.04
Armenia	22.54	81.64	76.36
Austria	43.71	88.64	89.02
Azerbaijan	13.47	58.49	60.35
Bahamas	14.38	59.86	50.87
Bangladesh	7.64	41.82	34.11
Barbados	28.38	90.17	84.76
Belgium	44.90	75.90	86.34
Belize	20.13	75.59	72.78
Bolivia	20.30	71.52	72.95
Bosnia and Herzegovina	36.52	93.92	93.47
Brazil	32.63	93.99	93.06
Brunei	9.29	31.83	38.44
Burkina Faso	15.91	89.97	88.58
Central African Republic	8.17	69.64	54.65

Chile	20.77	60.62	69.05
China	22.33	92.12	91.57
Colombia	21.30	81.77	79.63
Congo, Dem. Rep.	8.08	40.69	43.79
Congo, Rep.	8.31	41.65	37.76
Costa Rica	14.22	45.76	46.55
Cote d'Ivoire	13.19	59.84	63.90
Czech Republic	33.91	67.19	79.27
Denmark	47.97	92.05	90.14
Dominican Republic	14.41	50.50	50.87
Ecuador	13.88	51.98	55.35
El Salvador	19.90	77.56	81.27
Estonia	33.83	84.13	82.68
Eswatini	24.67	91.99	91.04
Finland	43.23	88.97	86.93
France	47.27	93.49	91.38
Georgia	22.58	71.53	71.28
Germany	40.90	82.43	84.94
Ghana	13.29	53.57	49.36

Greece	39.24	89.11	85.79
Guatemala	12.23	60.93	62.62
Guinea	12.06	76.07	77.44
Honduras	19.20	85.63	88.02
Hungary	34.09	76.35	85.74
Iceland	35.13	84.06	83.58
India	17.65	82.97	76.03
Indonesia	9.12	37.44	37.19
Ireland	21.85	51.16	52.99
Israel	32.79	88.74	77.66
Italy	43.28	91.95	90.72
Jordan	17.33	72.36	73.16
Kazakhstan	15.88	52.37	52.59
Kenya	14.63	81.29	70.56
Kyrgyzstan	24.87	83.29	83.14
Latvia	30.92	69.53	75.17
Lebanon	5.78	22.47	23.34
Lesotho	30.00	94.72	95.02
Lithuania	32.68	69.28	76.28

Luxembourg	39.89	91.94	85.67
Madagascar	10.67	60.86	64.10
Malaysia	11.24	31.83	40.68
Mali	15.06	89.05	90.42
Malta	30.33	81.15	74.17
Mauritania	10.76	50.61	57.26
Mauritius	19.46	68.61	66.93
Mexico	13.87	41.76	53.23
Moldova	29.45	86.82	85.23
Mongolia	27.74	81.30	84.95
Montenegro	36.77	93.68	89.77
Morocco	19.55	77.85	83.97
Namibia	28.17	89.59	91.36
Nepal	23.01	92.43	89.35
Netherlands	40.16	72.76	83.22
Nicaragua	27.12	94.20	93.91
Niger	10.05	85.05	75.52
North Macedonia	27.25	82.32	87.05
Norway	41.59	87.90	86.61

Oman	3.79	25.02	14.83
Pakistan	11.31	77.17	69.06
Panama	12.50	50.93	43.06
Paraguay	10.79	39.79	43.34
Peru	15.68	54.95	58.13
Philippines	14.13	54.74	54.33
Poland	37.81	83.88	87.85
Portugal	37.42	88.95	89.18
Romania	27.11	78.25	80.64
Rwanda	14.82	86.18	79.34
Senegal	16.93	88.10	88.27
Serbia	39.34	92.80	92.43
Seychelles	27.31	76.48	84.87
Sierra Leone	12.57	81.43	73.47
Singapore	13.12	28.46	34.65
Slovakia	35.65	74.87	85.02
Slovenia	37.75	74.88	83.77
South Africa	27.85	86.16	86.85
South Korea	29.88	76.73	78.30

Spain	38.95	89.85	89.38
Sri Lanka	7.54	27.83	25.31
Sweden	42.98	86.90	86.94
Switzerland	28.61	61.83	66.88
Tajikistan	19.46	87.29	85.57
Tanzania	10.71	63.89	55.33
Thailand	16.23	53.24	63.93
Trinidad and Tobago	16.42	50.67	54.60
Turkey	24.95	81.27	82.77
Ukraine	31.40	88.70	88.35
United Kingdom	34.26	85.15	79.27
United States of America	26.82	78.98	74.64
Uruguay	26.51	86.52	77.36
Uzbekistan	22.31	88.33	86.35
Zambia	16.05	67.33	76.64
Zimbabwe	14.89	75.72	68.86